

The opinion in support of the decision being entered today was not written for publication and is not binding precedent of the Board.

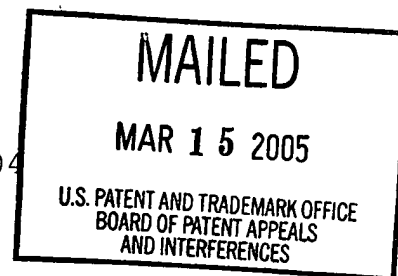
UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte PAUL KWOK KEUNG HO,
MEI SHENG ZHOU AND
CHOCKALINGAM RAMASAMY

Appeal No. 2005-0649
Application No. 09/518,204

ON BRIEF



Before OWENS, KRATZ and DELMENDO, Administrative Patent Judges.
KRATZ, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the examiner's final rejection of claims 1-18, which are all of the claims pending in this application.

BACKGROUND

Appellants' invention relates to a chemical mechanical polishing method wherein recessed portions of a substrate are filled with a metal layer and the metal layer is polished using a polishing agent that includes an etching agent and a chemical

agent. The chemical agent comprises a carbonyl derivative of benzotriazole that serves to protect the metal layer (appellants' specification, page 11). A further understanding of the invention can be derived from a reading of exemplary claim 1, which is reproduced below.

1. A polishing method comprising the steps of:

forming a layer made of material containing a metal as a main component over a substrate having recessed portions on a surface thereof so as to fill said recessed portions with said metal layer; and

polishing said metal layer by a chemical mechanical polishing method using a slurry including a polishing agent containing

a chemical agent being responsible for forming a protective film on the surface of said metal layer by reacting with said material containing a metal as a main component, wherein said chemical agent includes at least a carbonyl derivative of benzotriazole, and

an etching agent being responsible for etching said material containing a metal as a main component.

The prior art references of record relied upon by the examiner in rejecting the appealed claims are:

Sasaki et al. (Sasaki) 5,770,095 Jun. 23, 1998

Ng et al. (Ng)¹, "Synthesis of some Carbonyl Derivatives of BTA and Determination of their Inhibition Properties for Copper in 3%

¹ Our references to Ng in this decision are to the English language translation of record.

NaCl Solution," Corrosion Science and Protection Technology, Vol. 9, No. 3 (July 1997), pp. 201-204.

Claims 1-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sasaki in view of Ng.

We refer to the brief and to the answer for a complete exposition of the opposing viewpoints expressed by appellants and the examiner concerning the issues before us on this appeal.

OPINION

Having carefully considered each of appellants' arguments set forth in the brief, appellants have not persuaded us of reversible error on the part of the examiner with respect to appealed claims 1-3, 5-10, 12-15, 17 and 18. Accordingly, we will affirm the examiner's rejection of those claims for substantially the reasons set forth by the examiner in the answer. Because we find that the scope of claims 4, 11 and 16 is not readily determinable, we reverse, pro forma, the examiner's § 103(a) rejection of those claims and introduce a new ground of rejection of those latter claims under the second paragraph of § 112. Our reasoning follows.

Appellants state that the claims do not stand or fall together. Therefore, we consider the appealed claims separately to the extent that they have been separately argued.

Concerning independent claims 1, 8 and 14, appellant does not furnish separate arguments. Accordingly, we select claim 1 as representative of those claims.

Appellants do not dispute that Sasaki discloses a chemical mechanical polishing (CMP) process corresponding to appellants' representative appealed claim 1 process other than arguing that Sasaki does not explicitly describe the use of carbonyl derivatives of benzotriazole as a protective agent in the CMP process disclosed therein. See pages 7 and 8 of the brief.

Concerning this matter, we note that the examiner does not assert that Sasaki fully describes appellants' claimed process by specifying the use of carbonyl derivatives of benzotriazole as a protective agent in the CMP process disclosed therein. Rather, the examiner relies on Ng for disclosing carbonyl derivatives of benzotriazole as being known metal (copper) protective agents in combination with Sasaki for establishing the prima facie obviousness of the claimed process. In the examiner's view (answer, page 4):

it would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize the carbonyl derivative of BTA, as taught by Ng[,] in the polishing method of Sasaki, in lieu of various derivatives of BTA, as suggested by Sasaki, because Ng teaches that a carbonyl derivative of benzotriazole has a higher inhibition rate than BTA in the sense that the carbonyl derivative of benzotriazole produces a chelation reaction with copper ions, creating a protective film with more intensive hydrophobic resistance against penetration (translation: page 9, lines 20-23) and can be used for protection of copper on printed circuit boards (translation: page 2, lines 21-23).

According to appellants, however, the combination of Sasaki and Ng as proposed by the examiner is unpersuasive of the obviousness of appellants' claimed process because:

the prior art lack a suggestion that the reference should be modified in a manner required to meet the claims; the Examiner has not presented a convincing line of reasoning as to why the claimed subject matter as a whole, including its differences over the prior art, would have been obvious; the prior art references do not contain any suggestions (express or implied) that they be combined, or that they be combined in the manner suggested; and each reference is complete and functional in itself, so there would be no reason to use parts from or add or substitute parts to any reference.

We do not find appellants' arguments persuasive for the reasons stated above and in the examiner's rejection as set forth in the answer as well as for the reasons stated in the examiner's rebuttal (answer, pages 6-8), with which we concur.

In this regard, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. In re Keller, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981). Thus, while there must be some teaching, reason, suggestion, or motivation to combine the teachings of the cited references to arrive at appellants' claimed subject matter, it is not necessary that the cited references or prior art specifically suggest making the combination (see B.F. Goodrich Co. v. Aircraft Braking Systems Corp., 72 F.3d 1577, 1583, 37 USPQ2d 1314, 1319 (Fed. Cir. 1996) and In re Nilssen, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988)) as appellants would apparently have us believe.

Here, for reasons well stated by the examiner in the answer, the applied references taken together provide ample evidence that would have suggested employing the carbonyl derivatives of BTA of Ng as a substitute or addition to the BTA derivative chemical agent used in the method of Sasaki with the reasonable expectation that such a modification of Sasaki would result in

forming a reasonably successful protective film on the substrate surface to be polished by Sasaki's method. In particular, we note that the BTA or BTA derivative chemical agent used in the polishing method of Sasaki is disclosed as functioning to protect the metal by suppressing corrosion or oxidation thereof. See, e.g., column 5, lines 4-40 of Sasaki. Sasaki further provides that the chemical agent has hydrophobic properties and can be a derivative of BTA or a mixture of such derivatives. See, e.g., column 3, lines 38-65 and column 8, lines 11-32 of Sasaki. Ng further teaches that some carbonyl derivatives of BTA, which carbonyl derivatives are within the scope of appellants' claims, possess higher hydrophobic effect and protective properties for copper (as corrosion inhibitors) than BTA. See, e.g., pages 8 and 9 of Ng.

On this record, appellants simply have not persuasively refuted the particularized rationale provided by the examiner for combining the references as supported by the evidence supplied in fashioning the stated rejection.

Concerning dependent claim 2, appellants additionally argue that the benzotriazole formula thereof represents an unobvious limitation over Sasaki or Ng. However, the examiner's rejection is based on the combined teachings of Sasaki and Ng, not Sasaki

or Ng. Moreover, for the reasons stated by the examiner at page 9 of the answer, we do not find appellants' additional argument with respect to appealed dependent claim 2 persuasive. For example, the C3/BTA structure depicted at page 6 of Ng is a BTA derivative that is included within the scope of claim 2 as evident by comparing appellants' claim 2 formula where R is selected as an ethyl group, an option provided for in claim 2, with the C3/BTA structure of Ng.

Separately argued claim 9, like claim 2, requires that the carbonyl derivative of benzotriazole that is employed in appellants' polishing process is restricted to one of 10 specified carbonyl derivatives. Based thereon, appellants further argue that claim 9 is nonobvious because that limitation as to the carbonyl derivative of BTA is not taught or suggested by Sasaki or Ng in combination with the features of claim 8², from which claim 9 depends. However, for reasons discussed above with respect to claim 2 and as explained by the examiner in the

² We note that claim 8 substantially corresponds to claim 1, which latter claim, was held to be representative of claims 1, 8 and 14 (on this record) and was found to be unpatentable, for reasons discussed above and in the answer. In this regard, we note that separately argued claim 9, by virtue of a dependency on claim 8, also requires that the metal film that is treated is made of copper. However, both of the applied references are concerned with protecting copper metal. See, e.g., column 3, lines 55-65 of Sasaki and page 2 of Ng.

answer, those contentions of appellants are not persuasive given the combined teachings of the applied references with respect to protecting copper metal with BTA derivatives, including the teachings of Ng concerning carbonyl derivatives, that correspond to appellants' claimed derivatives, being effective in protecting copper.

Appellants group claims 3, 10 and 12 together in making a separate argument for the patentability thereof rather than arguing those dependent claims as being separately patentable. Therefore, we select claim 3 as representative thereof. Appellants maintain that the representative claim 3 requirement that the etching agent employed in the claim 1 CMP process includes: (1) an oxidizer; (2) an acid or base; and (3) a buffering agent or organic amine is not taught or suggested by the applied references. However, as correctly pointed out by the examiner (answer, page 9), Sasaki (column 4, lines 1-12 and column 8, lines 11-32) reasonably suggests employing a variety of etching agents including, inter alia, hydrogen peroxide (an oxidizer), aminoacetic acid (an organic amine) and a variety of other acids, including mixed acids. From that disclosure of Sasaki, we agree with the examiner that it would have been

obvious to one of ordinary skill in the art at the time of the invention to select an etching agent composition corresponding to appellants' etchant by simply following the teachings of Sasaki and in so doing in combination with the teachings of Ng, as discussed above and in the answer, arrive at a process corresponding to the process of representative claim 3 with a reasonable expectation of success in so doing.

Appellants group claims 5, 12 and 17 together in making a separate argument for the patentability thereof rather than arguing those dependent claims as being separately patentable. Therefore, we select claim 5 as representative thereof. In addition to the limitations recited in claim 1, representative claim 5 requires that the claimed BTA derivative "comprises from about 0.0001 to 10 weight% of said polishing agent." Appellants urge that the applied prior art does not teach or suggest the use of the claimed derivative in such an amount. In this regard, appellant urges that routine experimentation would not have resulted in a determination of the claimed amount of derivative by one of ordinary skill in the art.

Appellants' argument is not well taken because Sasaki reasonably suggests that the amount of BTA or BTA derivative

employed is a result effective variable. See, e.g., column 7, lines 22-35 of Sasaki. See In re Boesch, 617 F.2d 272, 276, 205 USPQ 215, 219 (CCPA 1980) ("[D]iscovery of an optimum value of a result effective variable in a known process is ordinarily within the skill of the art."); In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) ("[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.").

Concerning claims 6, 13 and 18, appellants group the claims together in making a separate argument for the patentability thereof rather than arguing those dependent claims as being separately patentable. Therefore, we select claim 6 as representative thereof. In addition to the limitations recited in claim 1, representative dependent claim 6 requires that the claimed BTA derivative "comprises from about 0.01 to 5.00 weight% of said polishing agent." Appellants essentially make the same argument for representative claim 6 that was made for claim 5, as discussed above. Consequently, on this record, we will affirm the examiner's rejection of dependent claims 5, 6, 12, 13, 17 and 18 for the reasons discussed above and in the answer.

Dependent claim 7 requires a process as recited in claim 1 wherein the metal is limited to copper, aluminum or an alloy of either of those metals. Appellants urge that restricting the metal as specified in claim 7 represents a non-obvious limitation in combination with the features of claim 1. However, as correctly found by the examiner (answer, page 11), Sasaki discloses that the polishing method disclosed therein can be applied to substrates with a copper metal film for protecting that metal. Similarly, Ng is directed to protecting copper metal. Consequently, for the reasons discussed above and in the answer, we agree with the examiner's determination that the combination of Sasaki and Ng render the subject matter of claim 7 prima facie obvious. Nor has that determination been persuasively refuted by appellants' arguments, for reasons discussed above and in the answer.

Our disposition of the examiner's rejection of claims 4, 11 and 16 is another matter. Dependent claims 4, 11 and 16 require that the etching agent includes at least three ingredients, one of which is either an HF acid or a base. The base is recited as having the molecular formula "(CH₃)N(OH)." Because we find that the chemical formula in those claims renders the scope of the affected claims undeterminable, for reasons discussed below, we

reverse the examiner's § 103(a) rejection thereof.³ See In re Steele, 305 F.2d 859, 862, 134 USPQ 292, 295 (CCPA 1962). It should be understood, however, that our reversal of this rejection of those claims is not a reversal on the merits thereof, but rather a procedural reversal predicated upon the failure of those claims to set forth the subject matter sought to be patented with a reasonable degree of precision and particularity.

New Ground of Rejection

Pursuant to 37 CFR § 41.50(b), we enter the following new rejection.

Claims 4, 11 and 16 are rejected under 35 U.S.C. § 112, second paragraph, for failing to particularly point out and distinctly claim the subject matter which appellant regards as the invention.

The test for compliance with the second paragraph of Section 112 is "whether the claim language, when read by a person of ordinary skill in the art in light of the specification, describes the subject matter with sufficient precision that the

³ We note that the examiner has not established that the applied references teach or suggest using HF acid, the other claimed option for the etching agent component of those claims.

bounds of the claimed subject matter are distinct." In re Merat, 519 F.2d 1390, 1396, 186 USPQ 471, 476 (CCPA 1975). In other words, the issue is whether a claim reasonably apprises those of skill in the art of its scope. In re Warmerdam, 33 F.3d 1354, 1361, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994).

Regarding claims 4, 11 and 16, the process required by those claims includes the use of a component as part of the etching agent, the scope of which component is not readily determinable. In this regard, a base having the molecular formula " $(\text{CH}_3)\text{N}(\text{OH})$ " appears to include an error in that claimed formula, the correction of which error is not made plain from a reading of the claims in light of appellants' specification. That formula error is made manifest by considering the two groups attached to the nitrogen atom in the recited formula and the known formulae⁴ of ammonium hydroxide " $\text{NH}_4(\text{OH})$ " and methylamine " $(\text{CH}_3)\text{NH}_2$." As is readily apparent from a review of the known formula of methylamine, the nitrogen atom is attached to two hydrogen atoms and one methyl group in that compound. Thus, the nitrogen atom displays a valence of -3. In the known formula of ammonium

⁴ See the definitions of ammonium hydroxide and methylamine at pages 50, 51 and 559 of Hawley, The Condensed Chemical Dictionary, Ninth Ed.(1977), Van Nostrand Reinhold Company (copy attached).

hydroxide, the nitrogen atom has four hydrogen atoms attached thereto, representing a plus one electron state for the NH_4 group that is attached to the hydroxyl group which latter group has a valence of -1. Thus, again, the nitrogen atom displays a valence of -3 in the ammonium ion with the four hydrogens collectively representing a valence of +4. While elemental nitrogen may display other valences in different types of compounds, the formula in the claims at issue here that includes a hydroxyl ion (valence = -1) and an ammonium ion (valence = +1) reasonably appears to suggest error in that claimed formula. Indeed, another comparison of the claimed formula with the compound of methyl alcohol (CH_3OH)⁵ further illustrates the apparent error in the claimed " $(\text{CH}_3)\text{N}(\text{OH})$ " limitation, which does not indicate any overall change. This being the case, the formula requirement of the base component of the etching agent of claims 4, 11 and 16 appears to be inconsistent with the known chemical bonding properties of nitrogen, methyl groups and hydroxyl groups, thereby rendering the scope of those claims unclear as to the particular base required thereby.

⁵ See the definition of methyl alcohol at page 558 of Hawley, The Condensed Chemical Dictionary, Ninth Ed.(1977), Van Nostrand Reinhold Company (copy attached).

CONCLUSION

The decision of the examiner to reject claims 4, 11 and 16 under 35 U.S.C. § 103(a) as being unpatentable over Sasaki in view of Ng is reversed on procedural grounds. The decision of the examiner to reject claims 1-3, 5-10, 12-15, 17 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Sasaki in view of Ng is affirmed. A new rejection of claims 4, 11 and 16 has been made.

Regarding the affirmed rejection, 37 CFR § 41.52(a)(1) provides "[a]ppellants may file a single request for rehearing within two months from the date of the original decision of the Board."

In addition to affirming the examiner's rejection of one or more claims, this opinion contains a new ground of rejection pursuant to 37 CFR § 41.50(b) (effective September 13, 2004, 69 Fed. Reg. 49960 (August 12, 2004), 1286 Off. Gaz. Pat. Office 21 (September 7, 2004)). 37 CFR § 41.50(b) provides "[a] new ground of rejection pursuant to this paragraph shall not be considered final for judicial review."

37 CFR § 41.50(b) also provides that appellants, WITHIN TWO MONTHS FROM THE DATE OF THE DECISION, must exercise one of the

following two options with respect to the new ground of rejection to avoid termination of the appeal as to the rejected claims:

(1) Reopen prosecution. Submit an appropriate amendment of the claims so rejected or new evidence relating to the claims so rejected, or both, and have the matter reconsidered by the examiner, in which event the proceeding will be remanded to the examiner

(2) Request rehearing. Request that the proceeding be reheard under § 41.52 by the Board upon the same record

Should appellants elect to prosecute further before the examiner pursuant to 37 CFR § 41.50(b)(1), in order to preserve the right to seek review under 35 U.S.C. §§ 141 or 145 with respect to the affirmed rejection, the effective date of the affirmance is deferred until conclusion of the prosecution before the examiner unless, as a mere incident to the limited prosecution, the affirmed rejection is overcome.

If appellants elect prosecution before the examiner and this does not result in allowance of the application, abandonment or a second appeal, this case should be returned to the Board of Patent Appeals and Interferences for final action on the affirmed rejection, including any timely request for rehearing thereof.

AFFIRMED-IN-PART; 37 CFR § 41.50(b)

Romulo H. Delmendo
Administrative Patent Judge

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